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ABSTRACT

Two experiments were conducted to investigate the effects of notetaking on achievement while studying electronic text. In the first experiment, 83 students studied 1 of 3 sets of notes (partial, skeletal, and control) for the effects on posttest performance (on fact, structure, and transfer tests). No differences were found between groups on the fact or structure tests. However, on the transfer test students in the partial condition significantly outperformed those in the control condition. In the second experiment, 77 undergraduates studied 1 of 2 sets of notes (control versus partial), and a pairwise comparison was conducted to detect differences between the 2 groups on structure and transfer tests. No significant differences were found on the structure test, but once again, there was a significant difference found in favor of the partial condition. Providing students with partial notes on the computer may be more beneficial than having them take their own notes (without any guidance) when they are tested over transfer items. (Contains 2 figures, 2 tables, and 21 references.) (Author/SLD)

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Running head: Notetaking Format

Effects of Notetaking Format on Achievement When Studying ElectronicText

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Abstract

Two experiments were conducted to investigate the effects of notetaking on achievement while studying electronic text. In experiment 1, eighty-three students studied one of three sets of notes (partial, skeletal, and control) on posttest performance (fact, structure, and transfer tests). No differences were found between groups on the fact or structure tests. However, on the transfer test students in the partial condition significantly outperformed those in the control condition. In experiment 2, seventy-seven undergraduates studied one of two sets of notes (control vs. partial) and a pair-wise comparison was conducted to detect differences between the two groups on structure and transfer tests. No significant differences were found on the structure test, but once again, there was a significant difference found in favor of the partial condition. Providing students with partial notes on the computer may be more beneficial than having them take their own notes (without any guidance) when they are tested over transfer items.

Effects of Notetaking Format on Achievement While Studying Electronic Text

When students construct their own study notes to accompany text, they often perform better than students who studied from the notes provided by their instructor (Armbruster & Anderson, 1982; Kiewra, 1989; Russell, Caris, Harris, & Hendricson, 1983). It's conceivable that this effect can be magnified by providing students with an external framework for organizing their notetaking structures (Bernard, 1990; Kiewra, Dubois, Christian, & McShane, 1988). The activity of taking notes serves as an encoding function (DiVesta & Gray, 1972; Kiewra & Frank, 1988; Mayer, 1989; Peper & Mayer, 1978, 1986) in that information is "encoded" in a more permanent fashion rather than a temporary fashion (e.g., reading over instructor provided notes). Katayama and Robinson (1998) found favorable results for partially constructed notes over completed notes (like ones distributed by instructors) on transfer tests. Crooks and Katayama (1998) found that students in the partial condition (i.e., those given row and column headings and about half of the notes) outperformed students in a control condition (i.e., those who constructed their own notes without any framework) on structure tests (hierarchical relations).

The use of skeletal and partial outlines were found more beneficial than completed notes for medical students in a study by Russell et al. (1983) because it allowed students to incorporate their own experiences and to help elaborate the new information. In response to questionnaires, students found the skeletal notes advantageous for review, prior to the test and encouraged students to concentrate on their own note-taking strategy within the provided guidelines. Furthermore, it was concluded that the amount of information provided for students did make a difference on how students performed on tests and how much information they remembered as they completed their notes respectively.

Similarly, the nature of the notes (linear or spatial) provided for students by the instructors can make a difference. Spatial displays and diagrams have undergone a great transformation as a result of their effectiveness on learning (Robinson, Katayama, & Fan, 1996). Generally speaking, these displays have been viewed as formal study notes that may accompany text. Some displays, such as matrix notes contain more visual organization of the information, creating figures without a basic format (Winn & Holliday, 1982). Recently a few studies have explored how graphic organizers may be used when students study chapter-length text and are provided with multiple graphic organizers (Robinson & Kiewra, 1995; Robinson, Katayama, Dubois, & DeVaney, 1998). Having students read and study the text and then review after a delay appears to be optimal for learning concept relations and transferring those relations by applying them in

new contexts (Zimmer, 1885). One constant belief has been that spatial notes differed from texts in that the logical or syntactical relationships that exist among the concepts are presented spatially on the page rather than in sentence form (Winn, 1980).

In the present study, we wanted to examine students' notetaking behaviors when studying a passage of text on the computer via the internet (different from Zimmer, 1985). We also hoped that this activity would enable students to benefit from the activity of recording their own notes (encoding) without being too challenging (as explained by Kiewra et al.). Russell, Caris, Harris, and Hendricson (1983) previously found that skeletal and partial outlines were beneficial for medical students, but did not use computers. We felt that in today's world where computers have made their way into the classrooms, this study would allow us to see how they study, take notes, and review for an exam in a controlled environment.

Experiment 1

Methodology

This study investigated the effects of three types of notetaking formats (partial, skeletal, and control) on posttest performance (factual, structural, and transfer tests). The partial condition provided students with approximately half of the notes and required the students to key in the missing notes. Figure 1 presents an example of the partial notes format. The skeletal condition only provided the students with the headings and categories for which they were expected to complete all the relevant notes. Figure 2 presents an example of the skeletal notes format. The control condition consisted of a blank screen for each text passage in which students could take whatever notes they wished (as they would in their "normal" study time). With the exception of the control condition, the other conditions provided students with basic headings for conceptually organizing their notes. For example, column headings consisted of "definition" and "purpose" and row labels consisted of topics related to the content of the text passage.

A one-way design was used on the between-subjects factor of notetaking structure (partial vs. skeletal vs. control). For all three notetaking conditions, students were exposed to the text and note taking options via the computer.

Subjects

Eighty-three students from three undergraduate educational psychology courses at a mid-size state university in the mid-west participated in this experiment. Due to computer error, data for 10 students was incomplete and therefore eliminated from the analysis. Of the remaining

73 students, 55 were female and 18 were male. There were 27 students in the control, 24 in the partial, 22 in the skeletal conditions respectively.

Materials

The study materials used in this study were all presented on-line. The study materials included a short chapter-length text (approximately 3500 words) covering the basics of educational research (i.e., Borg & Gall, 1996; Howell, 1996; Kiess, 1989; McMillan, 1996; Shavelson, 1988), five sets of study notes (corresponding to each of the text passages), three tests: factual, structure, transfer, and an attitudinal survey.

The fact test was taken on-line and consisted of 15 multiple-choice items. The items were based on information explicitly stated in the text. The following is an example of an item on the fact test:

A _____ is employed when all members of a defined population have already been placed on a list, and every tenth name is selected for the sample.

a. linear systematic sampling method

b. stratified random sampling method

c. cluster sampling method

d. random assignment method

The structure test was distributed as a hard copy test and consisted of 14 items in which students had to recall the hierarchical structure of the text. The following is an example of an item on the structure test:

1. List three general scales of measurement used in the behavioral sciences.

The transfer test was also distributed as a hard copy and consisted of 10 items in which students had to apply their understanding of educational research to novel situations. The following contains the directions and sample item taken from the transfer test.

Match the appropriate term by letter with each of the following scenarios. Note that each term may be used once, more than once or not at all. Mark your answers in the space provided.

a. Content validity	f. Independent variable	k. Ordinal scale
b. Control variable	g. Inferential statistics	l. Predictive validity
c. Dependent variable	h. Interval-Ratio scale	m. Random Assignment
d. Descriptive statistics	i. Linear-systematic sample	n. Stratified Sample
e. Face validity	j. Nominal scale	

_____ Dr. Freudsex has been collecting demographic data from his students for the past two years. His data set includes students' age, sex, year in school, major, and ethnicity. These variables are most likely to be analyzed using which type of scale?

Results and Discussion

Separate one-way analyses of variance (ANOVA) were conducted on the factual, structure, and transfer test scores. All tests were conducted at alpha = .05 level of significance. The assumption of homogeneity of variance was supported for the factual test, $F(2, 69) = .375$, $p = .689$, as well for the transfer test, $F(2, 69) = 1.03$, $p = .363$ according to the results of Levene's

F tests. The assumption of homogeneity of variance was not supported for the structure test, F (2, 69) = 4.02, p = .022.

The main effect of notetaking format (partial vs. skeletal vs. control) was not statistically significant on the factual test, F(2, 69) = 1.04, MSE = 9.08, p = .360. This result indicates that the amount of information (partial, skeletal, or control) did not affect students' scores. Likewise for the structure test, the main effect of notetaking format was not statistically significant, F (2, 69) = 1.40, MSE = 11.53, p = .254. Because the structure test had a violation of homogeneity of variances, we conducted a non-parametric Kruskal-Wallis test on the structure scores which yielded a nonsignificant H, X^2 (2) = .915, p = .633. However, on the transfer test, the main effect of notetaking format was statistically significant, F, (2, 69) = 3.30, MSE = 20.78, p = .043. A Fisher's LSD was conducted to follow-up this effect. Students in the partial condition (M = 5.54, SD = 2.24) performed significantly better than those in the control condition (M = 3.77, SD = 2.87), but not significantly better than students in the skeletal condition (M = 4.22, SD = 2.30).

Conclusion

The purpose of this study was to investigate the relative effectiveness of three note taking formats (partial, skeletal, and control). Results indicated that partial notes were more effective than traditional note-taking strategies for helping college students transfer text knowledge. However, the results also indicate that there is minimal to no effect for notetaking format for learning text structure or facts. Therefore, in a practical educational setting, these results suggest that if teachers want student's to simply learn facts or basic structures within a text, there are no advantages among study note formats. However, if teachers are interested in testing students' ability to transfer their knowledge within a text, there are advantages among how much

information is provided for students to take their notes. In the present study, students who were provided with partial notes outperformed those who studied their own notes because they were better able to transfer the information.

Experiment 2

Because we found no differences between the three notetaking groups on the factual test we decided to concentrate on the structure and transfer tests. Also, due to a limited subject pool, we decided to narrow our focus to the two conditions in which we found differences between in experiment 1: control and partial notes.

Methodology

A pair-wise comparison was used because there were only two notetaking structures (partial vs. control), a between-subjects factor. For both conditions, students were exposed to the text and note taking options via the computer. The amounts of notes taken for each text passage were recorded in kilobytes (all keyed in characters). This did not include the column or row headings in the partial condition.

Subjects

Seventy-seven students from three undergraduate educational psychology courses at a mid-size state university in the mid-west participated in this experiment. Of the 77 students, 48 were female and 18 were male. Eleven students did not specify their sex. There were 35 and 42 in the control and partial conditions respectively.

Materials

The study materials used in this second experiment were the same used in experiment 1 with the exception of no skeletal notes condition. Also, no fact test was administered in this study.

The structure test was distributed as a hard copy test and consisted of 14 items in which students had to recall the hierarchical structure of the text. The transfer test was also distributed as a hard copy and consisted of 10 items in which students had to apply their understanding of educational research to novel situations.

Results and Discussion

An independent samples t-test was conducted on the structure and transfer tests. Both tests were conducted at alpha = .05 level of significance. Levene's test for equality of variances was supported for the structure test, $F(75) = .175$, $p = .677$ as well for the transfer test, $F(75) = 1.82$, $p = .182$. The effect of amounts of notetaking formats was not statistically significant on the structure test, $t(75) = .081$, $MSE = 4.76$, $p = .94$. However, on the transfer test, the effect of note taking formats was statistically significant, $t(75) = (-2.65)$, $MSE = -1.17$, $p = .010$. Students in the partial condition ($M = 6.40$, $SD = 2.06$) performed significantly better than those in the control condition ($M = 5.23$, $SD = 1.79$. Table 4 presents the means and standard deviations for the groups on the structure and transfer tests.

Conclusion

This study found similar results between the two conditions as the previous study. There were no significant differences between students in the partial or control conditions based on their performance on the structure test. Therefore, when we test for students understanding of hierarchical structure of text concepts, there is no advantage for partial notes. But, once again, we found that students who completed and studied the partial notes significantly outperformed the students in the control condition on the transfer test. Therefore it can be concluded that when we want students to apply what they have read, there seems to be an advantage of providing them with partial notes. Perhaps our findings are consistent with Peper and Mayers' studies (1978, 1986) where the encoding function of actually taking notes in an active manner allows for students to process the information at a deeper level as it surfaces on the transfer test.

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Table 1

Group Means and Standard Deviations for Experiment 1

	Fact Test		Structure Test		Transfer Test		
Condition	M	SD	M	SD	M	SD	N
Control	8.96	2.82	9.27	3.62	3.76	2.87	26
Partial	10.17	3.12	10.25	2.57	5.54	2.25	24
Skeletal	9.59	2.94	10.59	2.06	4.23	2.31	22

Table 2

Group Means and Standard Deviations for Experiment 2

	Structure Test		Transfer Test		
Condition	M	SD	M	SD	N
Control	9.57	2.51	5.22	1.78	35
Partial	9.52	2.59	6.40	2.06	42

FIGURE 1

Example of Partial Notes Format Used in Experiments 1 & 2

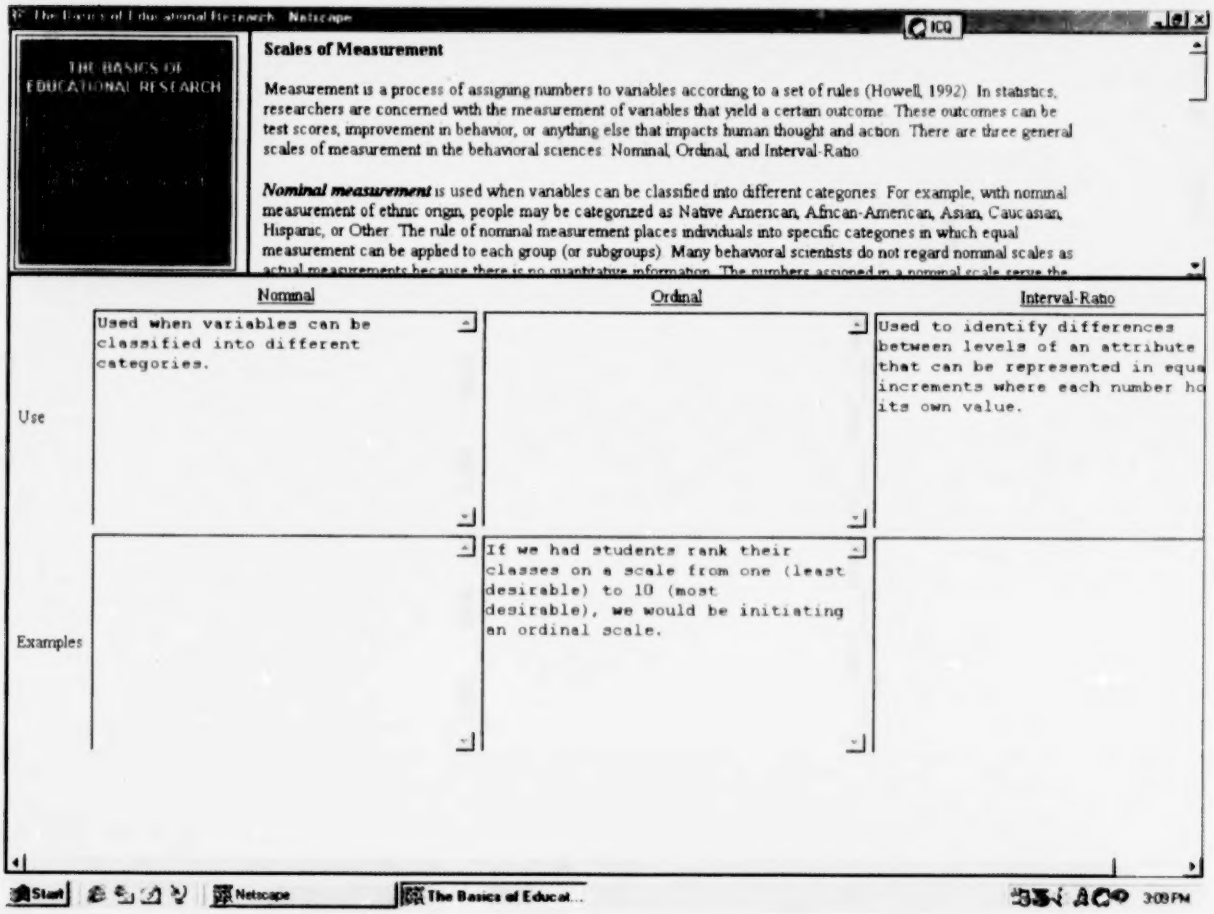
THE BASICS OF EDUCATIONAL RESEARCH
Scales of Measurement
Measurement is a process of assigning numbers to variables according to a set of rules (Howell, 1992). In statistics, researchers are concerned with the measurement of variables that yield a certain outcome. These outcomes can be test scores, improvement in behavior, or anything else that impacts human thought and action. There are three general scales of measurement in the behavioral sciences: Nominal, Ordinal, and Interval-Ratio.
Nominal measurement is used when variables can be classified into different categories. For example, with nominal measurement of ethnic origin, people may be categorized as Native American, African-American, Asian, Caucasian, Hispanic, or Other. The rule of nominal measurement places individuals into specific categories in which equal measurement can be applied to each group (or subgroups). Many behavioral scientists do not regard nominal scales as
Nominal
Ordinal
Interval-Ratio
Use
Used when variables can be classified into different categories.
Used to identify differences between levels of an attribute that can be represented in equa increments where each number ho its own value.
Examples
If we had students rank their classes on a scale from one (least desirable) to 10 (most desirable), we would be initiating an ordinal scale.
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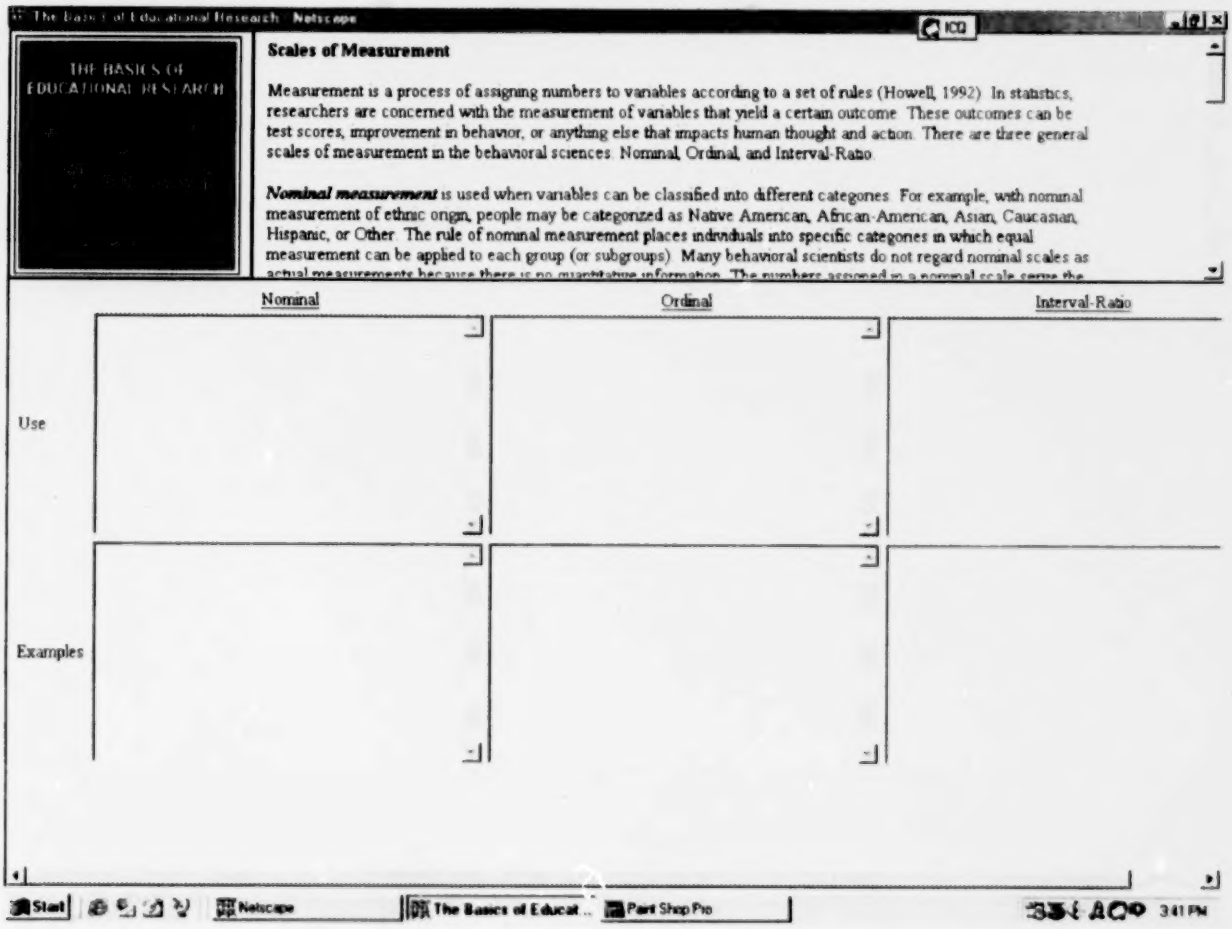
FIGURE 2

Example of Skeletal Notes Format Used in Experiments 1 & 2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